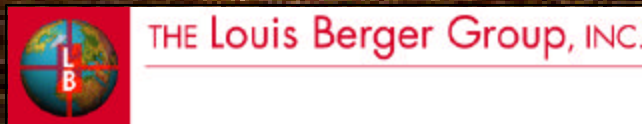


Bacteria TMDL Development for the Upper York River

Public Meeting #1

West Point, VA

January 20, 2010



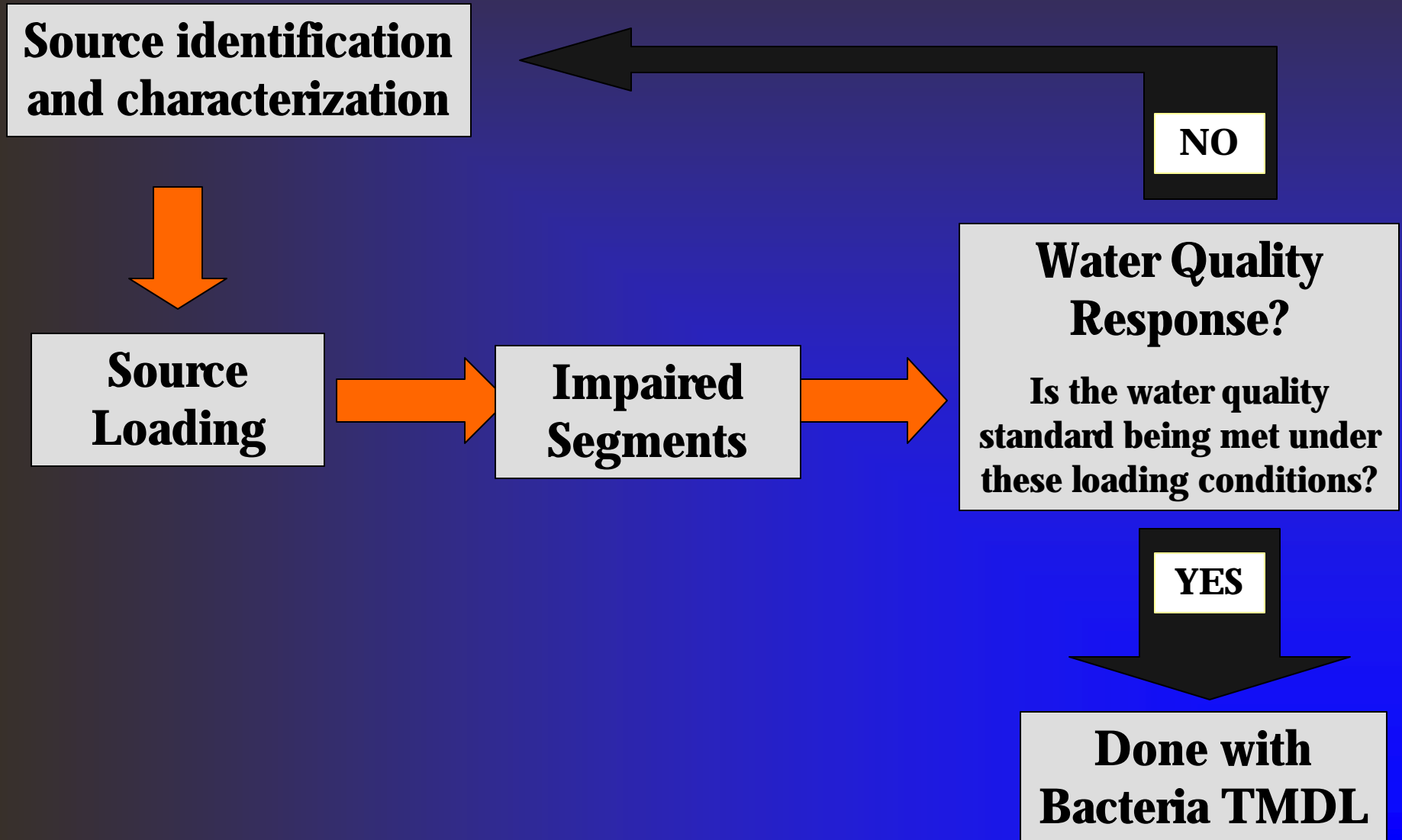
Agenda

- **Meeting Objective**
- **Impaired Segments**
- **Technical Approach**
- **Data and Information Needs**
- **Watershed Characterization**
- **Potential Bacteria Sources**
- **Next Steps**

Objective

- **To present and review the steps and the data used in the development of a Bacteria TMDL for the Upper York River**

Bacteria TMDL Development Process



Bacteria Impairments

Based on VADEQ 2008 303(d) List

Bacteria Impaired Segments and Water Quality Stations: Upper York River



Legend

- NOAA Tidal Station
- VDH-DSS Stations
- VADEQ Stations
- Pamunkey and Mattaponi Recreation
- Shellfish Impairment
- York Recreation
- County Line
- Cities

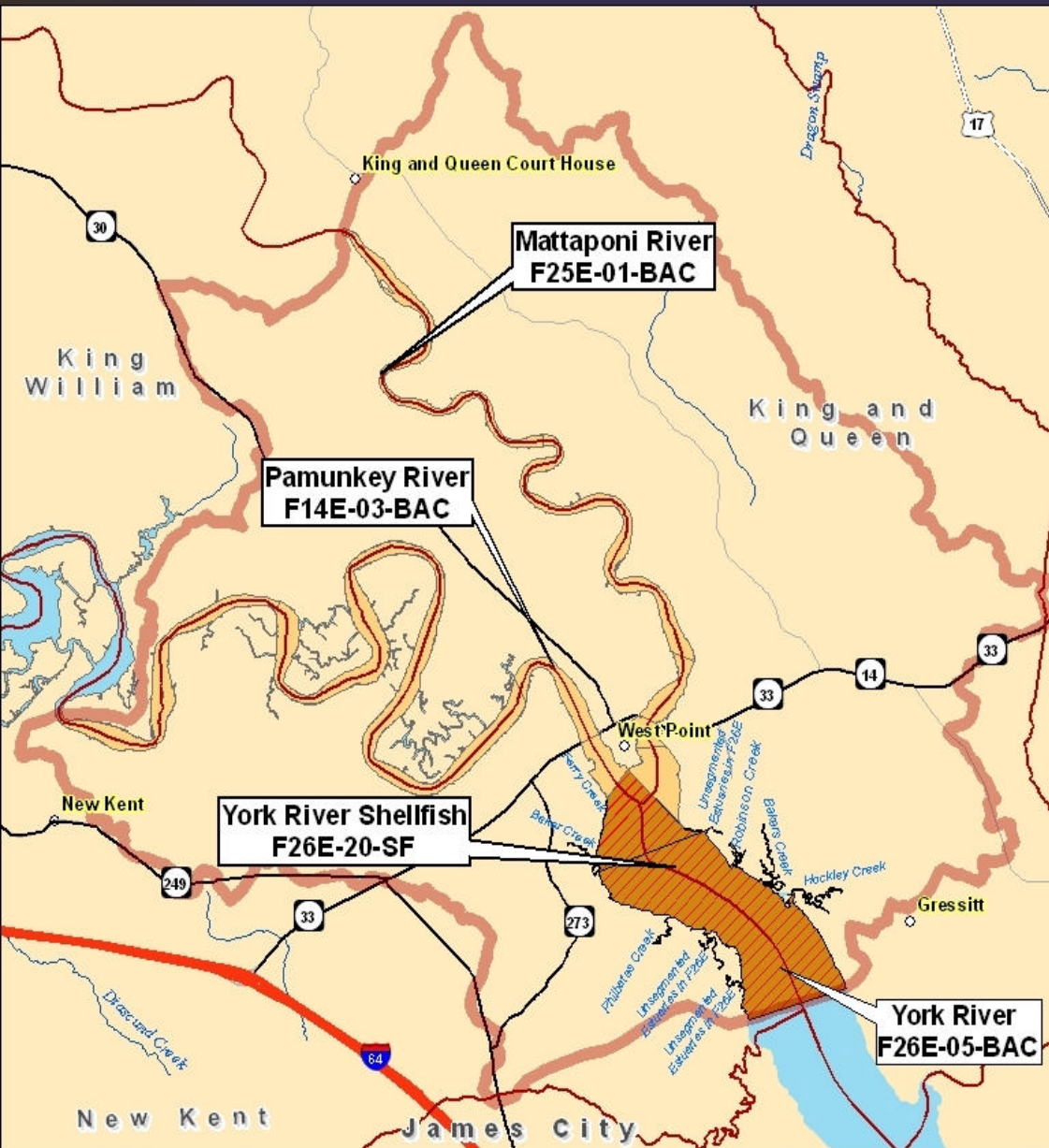
0 0.5 1 2 3 4 Miles



THE Louis Berger Group, INC.



Bacteria Impaired Segments : Upper York River



Legend

- NOAA Tidal Station
- VDH-DSS Stations
- VADEQ Stations
- Pamunkey and Mattaponi Recreation

- Shellfish Impairment
- York Recreation
- County Line
- Cities

0 0.5 1 2 3 4 Miles



Bacteria Impairments

Based on VADEQ 2008 303(d) List

List of Shellfish Waterbodies Requiring TMDL Development

| Cause Group Code | Shellfish Condemnation Area | Waterbody Name | Impairment | Estuary Area (mi²) | Impairment Source |
|-------------------------|------------------------------------|-----------------------|-------------------|--------------------------------------|--------------------------|
| F26E-20-SF | 049-004A (08/25/2005) | York River | Fecal Coliform | 7.218 | Unknown |

List of Recreation Waterbodies Requiring TMDL Development

| Cause Group Code | Waterbody Name | Impairment | Estuary Area (mi²) | Impairment Source |
|-------------------------|-----------------------|-------------------|--------------------------------------|--------------------------|
| F26E-05-BAC | York River | Enterococcus | 6.966 | Unknown |
| F14E-03-BAC | Pamunkey River | Enterococcus | 4.368 | Unknown |
| F25E-01-BAC | Mattaponi River | Enterococcus | 2.535 | Unknown |
| | | Total | 13.899 | |

Water Quality Standards

VADEQ specifies the following bacteria criteria to protect shellfish and recreational uses (VA DEQ, 2008):

Fecal Coliform

- Geometric Mean:
 - 14 cfu/100mL
- 90th Percentile:
 - 49 cfu/100mL

Enterococci

- Geometric Mean:
 - 35 cfu/100ml (applies to 2 or more samples obtained in 1 calendar month)
- Single Sample Maximum (SSM):
 - 104 cfu/100mL

VDH-DSS Fecal Coliform (shellfish) Exceedances at Stations in the Upper York River: All Tidal Conditions

| All Tidal Conditions | | | | | | | | |
|----------------------|------------------|-------------|-----------|-----|----------------|------|-----------------|------|
| Station ID | Stream | Sample Date | | # | Exceedances | | | |
| | | First | Last | | Geometric Mean | | 90th Percentile | |
| | | | | | # | % | # | % |
| 48-102 | Upper York River | 1/10/1985 | 4/29/2009 | 249 | 8 | 3% | 60 | 24% |
| 49-103 | | 1/10/1985 | 4/29/2009 | 241 | 34 | 14% | 114 | 47% |
| 49-104 | | 1/10/1985 | 4/29/2009 | 240 | 54 | 23% | 146 | 61% |
| 49-104A | | 1/10/1985 | 4/29/2009 | 237 | 237 | 100% | 237 | 100% |
| 49-104B | | 1/10/1985 | 4/29/2009 | 218 | 218 | 100% | 218 | 100% |
| 49-105 | | 1/10/1985 | 4/29/2009 | 241 | 119 | 49% | 160 | 66% |
| 49-106 | | 1/10/1985 | 4/29/2009 | 241 | 169 | 70% | 206 | 85% |
| 49-107 | | 1/10/1985 | 4/29/2009 | 241 | 175 | 73% | 201 | 83% |
| 49-204 | | 1/10/1985 | 4/29/2009 | 241 | 107 | 44% | 149 | 62% |
| 49-205 | | 1/10/1985 | 4/29/2009 | 241 | 180 | 75% | 210 | 87% |
| 49-206 | | 1/10/1985 | 4/29/2009 | 241 | 181 | 75% | 232 | 96% |
| 49-207 | | 1/10/1985 | 4/29/2009 | 241 | 179 | 74% | 209 | 87% |
| 50-202 | | 2/25/1985 | 4/29/2009 | 248 | 25 | 10% | 79 | 32% |
| 50-203 | | 2/25/1985 | 4/29/2009 | 248 | 48 | 19% | 151 | 61% |

VA DEQ Enterococci Exceedances at Stations in the Upper York River: All Tidal Conditions

| All Tidal Conditions | | | | | |
|----------------------|-----------------|-----------------|----------------|-----------------------------------|----|
| Station ID | Stream | Bacteria Source | No. of Samples | Single Sample Maximum Exceedances | |
| | | | | No. | % |
| 8-MPN004.39 | Mattaponi River | Enterococci | 63 | 21 | 33 |
| 8-PMK006.36 | Pamunkey River | Enterococci | 79 | 35 | 44 |
| 8-YRK031.39 | York River | Enterococci | 80 | 21 | 26 |

Technical Approach:

Simplified Volumetric Tidal Model

- **Used for small watersheds**
- **Incorporates point and non-point sources**
- **EPA accepted**
- **Time independent**
- **Uses a mass balance approach over a tidal period (~12 hrs)**
- **Assumes a completely mixed system (no density, concentration, and volume variations)**

Linking Sources to Water Quality

Input

Maximum bacteria concentration in the estuary
Maximum bacteria concentration at boundary (mouth of the estuary)
Volumes of water entering the bay, water flowing out of the bay, and net freshwater
Total daily bacteria die off rate



Model

Simplified Volumetric Tidal Model

Mass balance approach over an average tidal period (~12 hrs)
Completely mixed system (no density and concentration variations)



Output

Total Bacteria Load Capacity in the Impaired Waterbody

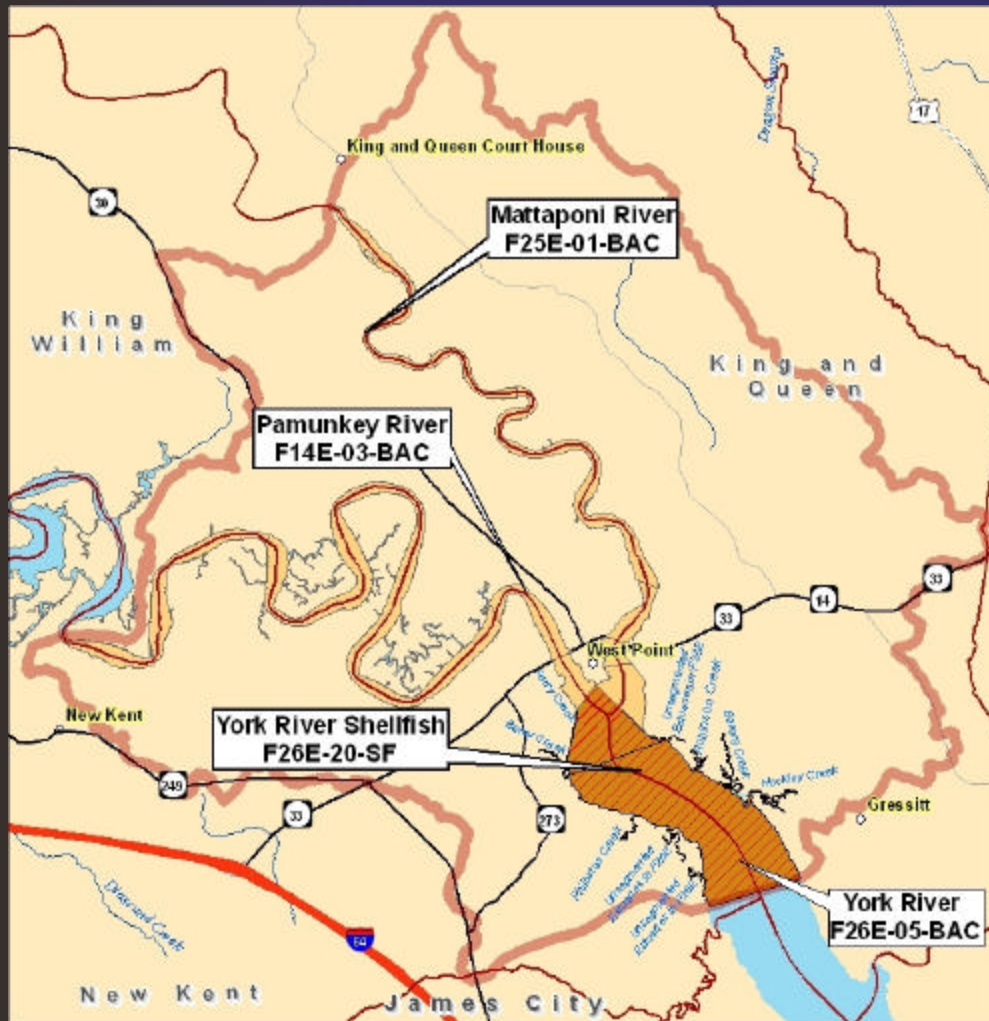
- Existing Load
- Allocated Load

Data and Information Needs for the Bacteria TMDL

- **Watershed physiographic data (land use distribution)**
- **Hydrographic data (tidal range, bathymetry, flow)**
- **Potential Pollutant Sources:**
 - Septic Systems and Straight Pipes
 - Livestock
 - Wildlife
 - Pets
- **Water Quality Monitoring Data (VADEQ, VDH-DSS stations)**

Watershed Characterization

Overview of the Upper York River Watershed



Total Area: 106,392 acres

Three Counties:

➤ **King and Queen, King William, New Kent**

➤ **Major Cities:**

➤ **West Point**

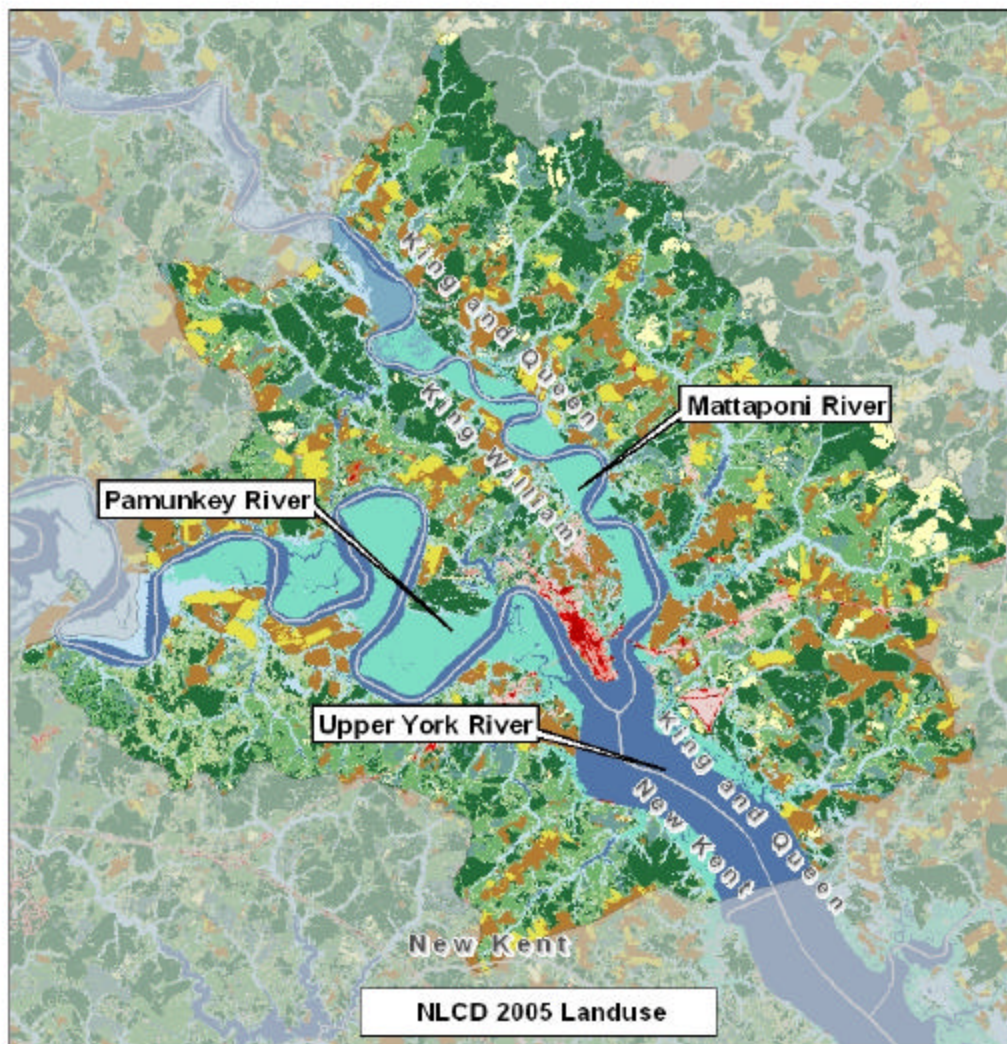
Major Roads:

➤ **Highway 249, 273, 30 and 33**

Main tributaries:

➤ **Pamunkey River and Mattaponi River**

Watershed Landuse



Used the most recent land use data:

National Land Cover Dataset (NLCD) 2005

Total Area: 106,392 acres

Dominant land uses:

Forest: 44% (46,566 acres)

Water/Wetland: 30% (31,943 acres)

Not dominant land uses:

Urban: 2% (2,582 acres)

Agriculture: 15% (15,743 acres)

Other: 9% (9,558 acres)

Point Sources: Permitted Facilities

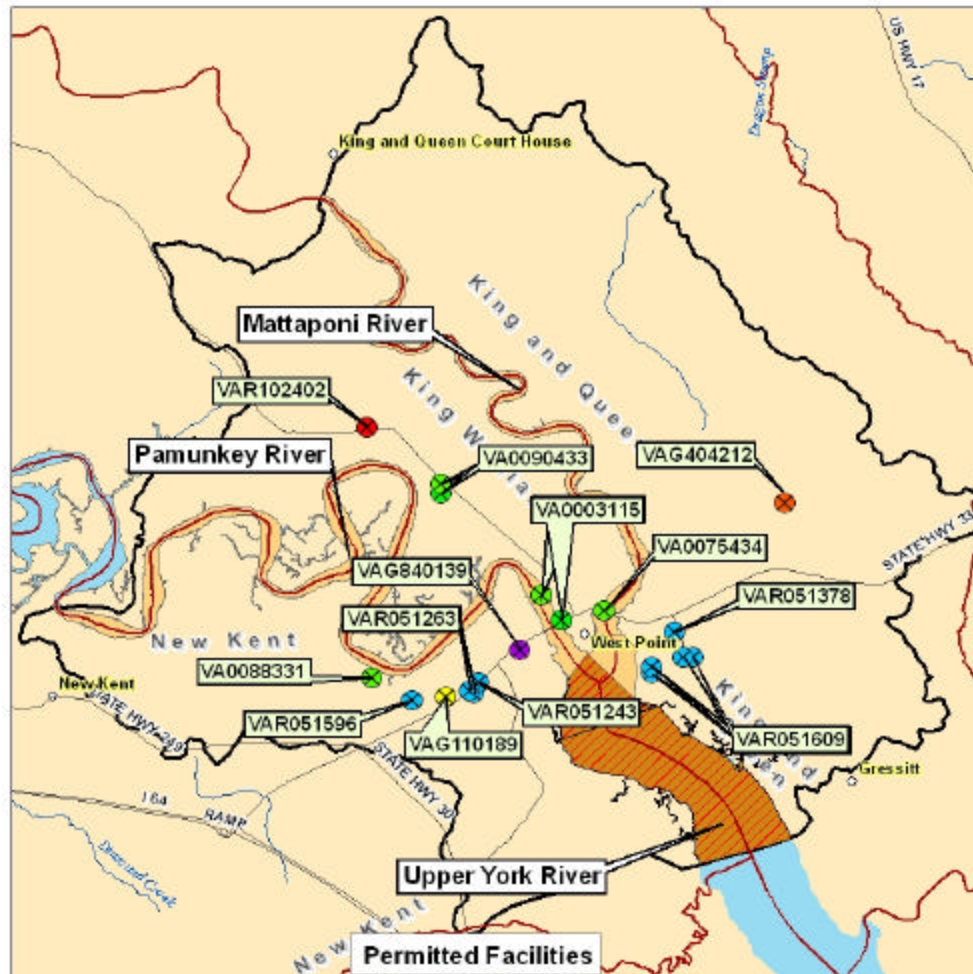
Total No. of Active Facilities: ~41

Individual Permitted Facilities:

| Permit Type | Number of Facilities |
|-----------------------------|----------------------|
| Municipal | 3 |
| Industrial and Other | 1 |
| Total | 4 |

General Permitted Facilities:

| Permit Type | Number of Facilities |
|--------------------------------|----------------------|
| Stormwater Industrial | 5 |
| Stormwater Construction | 29 |
| Car Wash, etc. | 3 |
| Total | 37 |



Legend

- ✕ Domestic
- ✕ NIMM
- ✕ Ready Mix
- ✕ SW Construction
- ✕ SW Industrial
- ✕ VPDES
- County Line
- VA_Roads
- Pamunkey and Mattaponi Recreation
- Shellfish Impairment
- York Recreation

0 0.5 1 2 3 4 Miles



Potential Bacteria Sources

- **Human Sources** (septic “failing or improperly functioning” systems, straight pipes)
- **Biosolids** (when applied improperly)
- **Livestock**
- **Wildlife**
- **Pets**

Septic Failures and Straight Pipes by County: Watershed Estimates

| Population Estimates for the Upper York River TMDL Watershed | | | | | | |
|---|-------------------------|-------------------------------|--|---|--|--|
| County | Population ¹ | Number of Houses ¹ | Number of Houses Public Sewer ² | Number of Houses on Septic Systems ² | Number of Houses on “Other Means” ² | Number of Houses with a Failing Septic System ³ |
| King and Queen | 1,633 | 802 | 4 | 744 | 54 | 89 |
| King William | 2,322 | 934 | 259 | 629 | 46 | 76 |
| New Kent | 3,325 | 1,327 | 14 | 1,283 | 30 | 154 |
| TOTAL | 7,281 | 3,063 | 277 | 2,657 | 130 | 319 |
| ¹ Census 2008 estimates | | | | | | |
| ² Based upon 2008 census estimate and ratio of parameter: 1990 census estimate | | | | | | |
| ³ Based on a septic failure rate of 12% (VA DEQ 2005) | | | | | | |

Estimates: Livestock in Watershed



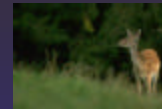
Livestock Present in the Upper York River TMDL Watershed

| County | Cattle | Pigs | Poultry | Horses | Sheep |
|----------------|------------|-----------|------------|------------|-----------|
| King and Queen | 339 | N/A | 36 | 73 | 20 |
| King William | 258 | 64 | 68 | 37 | 10 |
| New Kent | 124 | 4 | 129 | 75 | 12 |
| TOTAL | 721 | 67 | 232 | 185 | 42 |

- Data are based on information summarized by the Center for Coastal Resource Management (CCRM)

- N/A – Not Available

Estimates: Wildlife by County and Watershed



Wildlife Densities in the TMDL Watersheds¹

| Wildlife type | Population Density | Habitat Requirements |
|---------------------------|---|---|
| Deer | 0.047 animals/acre | Entire watershed |
| Raccoon (low density) | 10/square mile | Upland forest |
| Raccoon (high density) | 50/square mile | Bottomland forest, marsh, swamp, along streams |
| Muskrat (low density) | 2 animals/mile | 16/mile of ditch or medium sized stream intersecting agriculture crop fields, 8/mi of medium sized stream intersecting pasture fields, 10/mi of pond or lake edge, 50/mi of slow-moving river |
| Muskrat (high density) | 15 animals/mile | |
| Muskrat (average density) | 10 animals/mile | |
| Beaver (low density) | 1.0/mi of permanent streams and rivers | Permanent streams and rivers |
| Beaver (high density) | 14.5/mile | |
| Beaver (average density) | 4.8/mile | |
| Goose | 0.02 animals/acre | Entire Watershed |
| Canadian Goose | http://migbirdapps.fws.gov/ | Based on particular strata for watershed area |
| Mallard | | |
| Wood Duck | | |
| Black Duck | | |
| Wild Turkey | 0.01 animals/acre | Entire watershed excluding urban land uses |

¹ Source: Department of Game and Inland Fisheries (DGIF)

Estimates: Wildlife in Watershed

Wildlife Present in the Upper York River TMDL Watershed ¹

| County | Acres | Canadian Geese | Black Duck | Wood Duck | Mallard | Deer | Raccoon | Muskrat | Beaver |
|----------------|----------------|----------------|------------|-----------|------------|--------------|--------------|--------------|------------|
| King and Queen | 49,068 | 99 | 0 | 0 | 99 | 2,306 | 1,690 | 1,251 | 237 |
| King William | 26,433 | 53 | 0 | 0 | 53 | 1,242 | 1,215 | 949 | 180 |
| New Kent | 26,224 | 53 | 0 | 0 | 53 | 1,233 | 1,247 | 820 | 155 |
| TOTAL | 101,724 | 206 | 0 | 0 | 206 | 4,781 | 4,152 | 3,021 | 572 |

Differences in totals are due to rounding.

¹ Source: Department of Game and Inland Fisheries (DGIF)

Estimates: Pets in Watershed

| Pet Present in the Upper York River TMDL Watershed | | | |
|--|--------------|--------------|--------------|
| County | Households | Dogs | Cats |
| King and Queen | 802 | 436 | 476 |
| King William | 934 | 507 | 554 |
| New Kent | 1,327 | 720 | 787 |
| TOTAL | 3,063 | 1,663 | 1,816 |

Pet inventories based on:

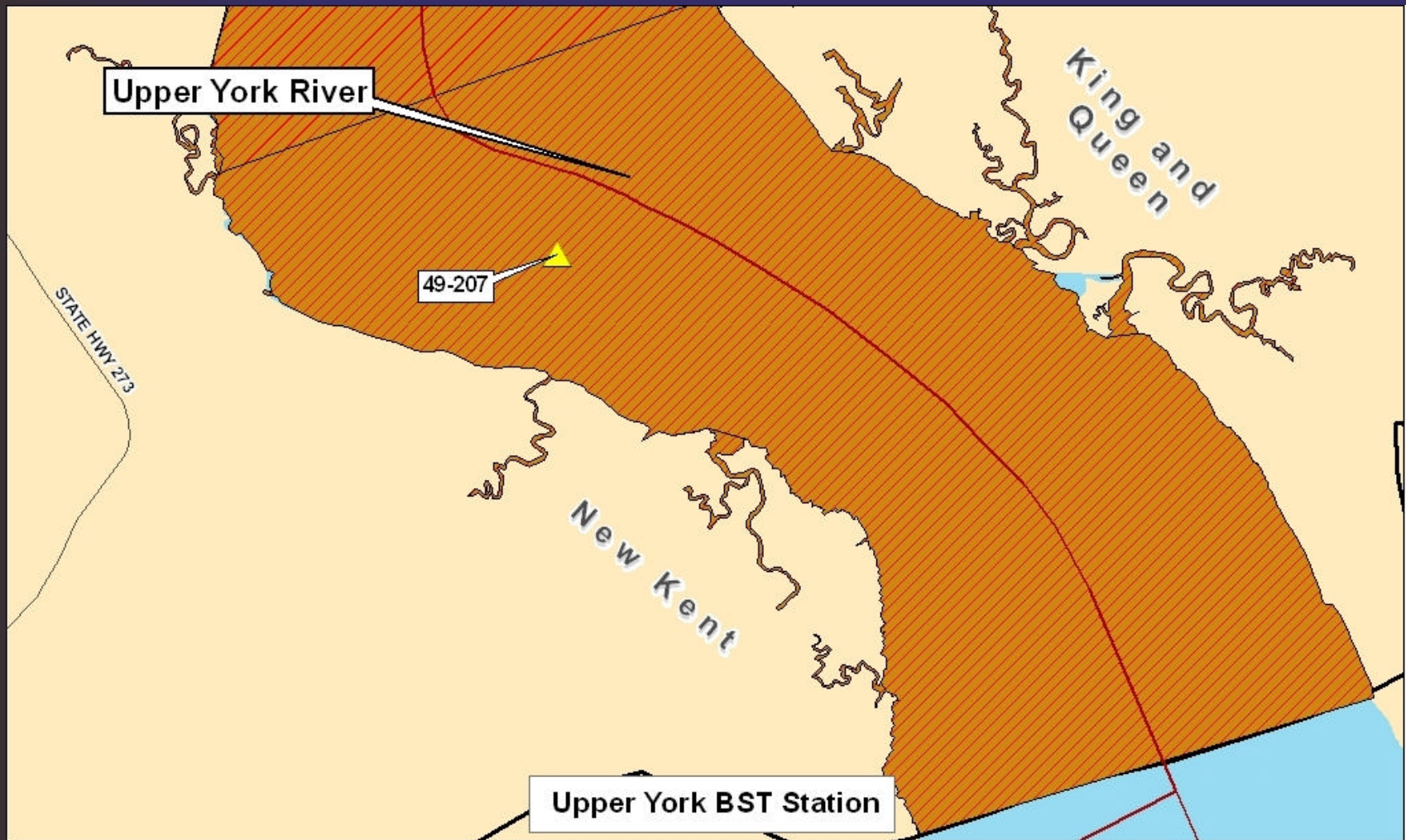
- Cats: 0.598 per household and
- Dogs: 0.543 per household

American Veterinary Medical Association (AVMA) estimates

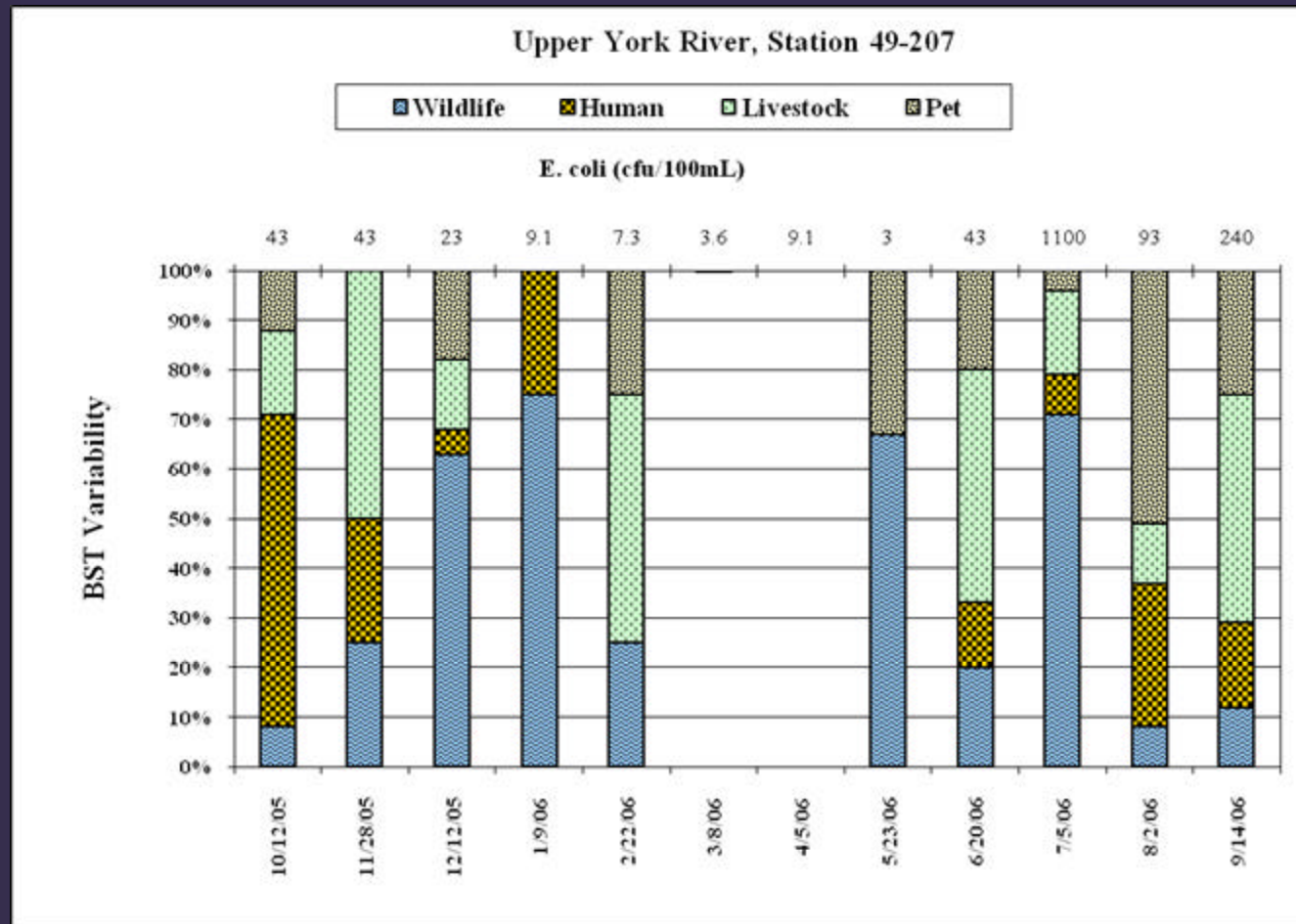
Bacteria Source Tracking (BST)

- **BST data were collected at one station by Virginia Department of Health (VDH)**
 - 1 station on the Upper York River
- **A total of 10 sampling events at each station between October 2005 and September 2006**
- **Results indicate that bacteria sources from human, livestock, wildlife, and pet are present in the watershed**
- **The BST distribution will be used to develop the TMDL allocations in the shellfish and recreation impairments of the York River**
- **No BST performed in the Mattaponi or Pamunkey Rivers therefore population estimates will be used to develop TMDL allocations.**

Location of Monitoring Stations for Bacteria Source Tracking (BST)



Bacteria Source Tracking, Upper York River



Bacteria Source Tracking

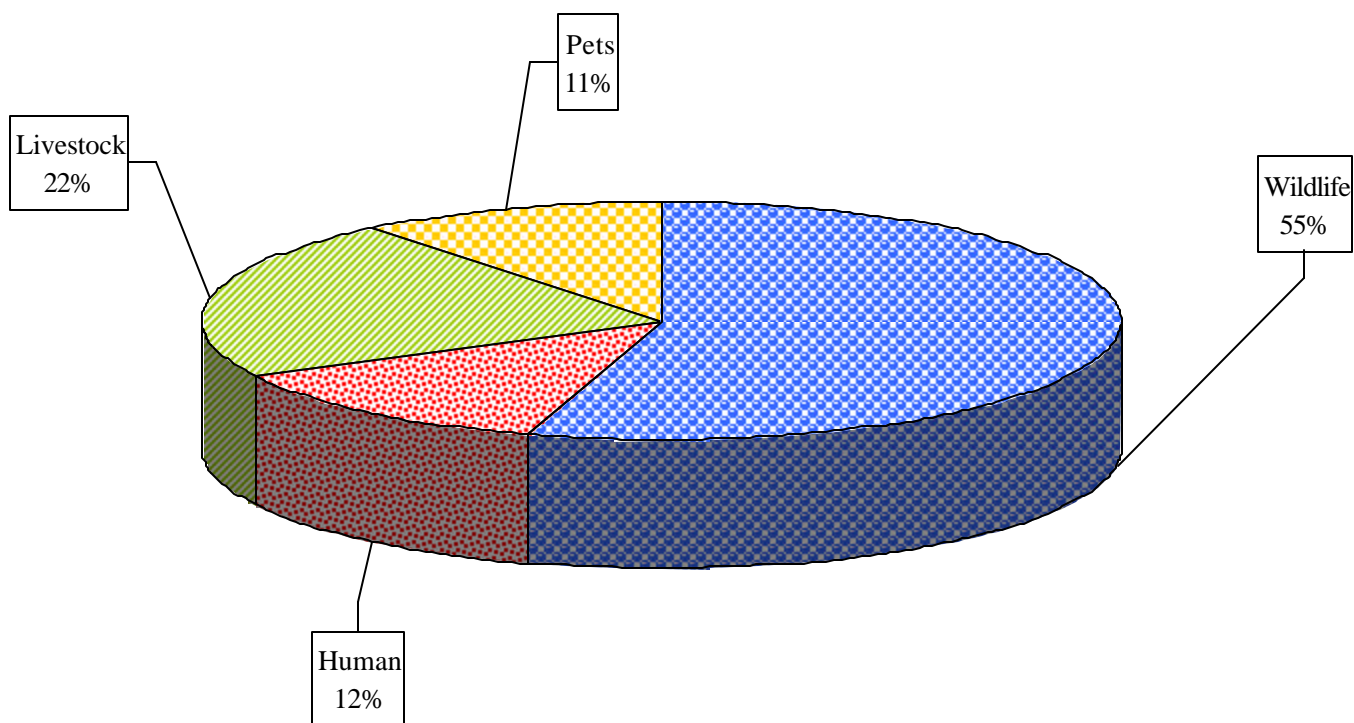
| Computed Weighted BST Fractions | | | | | |
|---------------------------------|---------|----------|-------|-----------|------|
| Segment | Station | Wildlife | Human | Livestock | Pets |
| Upper York River | 49-207 | 55% | 12% | 22% | 11% |

Note: Population estimates will be used to develop TMDL allocations for the Mattaponi and Pamunkey Rivers since no BST was performed in those rivers

Bacteria Source Tracking, Upper York River

Upper York River, Station 49-207

Wildlife Human Livestock Pets



Next Steps

- **30-day comment period starts tomorrow –
Ends on February 20th, 2010**
- **2nd Public Meeting (TBA)**
 - Draft TMDL Allocation
 - Draft TMDL Report
 - 2nd comment period
- **Present to EPA and SWCB for approval**
- **Implementation Planning**

TMDL Contacts



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